

## Morphologically Derived Environments and SSP Violations: The Case of Lezgi

Lezgi, a Nakh-Dagestanian language spoken in Russia and Azerbaijan, has been described as having a pattern of vowel alternation whereby high vowels in  $C_1VC_2$  roots delete when followed by stress attracting suffixes when  $C_1$  and  $C_2$  are voiceless obstruents (Haspelmath, 1993), leaving residual phonetic information on the preceding consonant. This pattern creates some sequences that violate the sonority sequencing principle (Selkirk, 1984), but conform to the phonotactics of the language. In addition to this synchronic phenomenon, a diachronic process caused homomorphic stems that possess the same environment to delete these vowels. See page 2 for examples of this phenomenon.

Previous research has characterized this phenomenon as the result of gestural overlap (Chitoran & Babaliyeva, 2007; Chitoran & Iskarous, 2008), causing vowel devoicing, but not the outright deletion of the vocalic gesture in these pretonic environments. Additionally, C&B claim that non-high vowels "are also overlapped, but because they are longer they are not completely hidden." I test the claim that vowel devoicing here results from gestural overlap due to timing by manipulating speech rate (Byrd, 1996). Results are consistent with previous research that there is a vocalic gesture following the initial consonant in the plural form. However, I found little evidence to suggest that vowel devoicing results from gradient gestural overlap. Instead, I claim this is a categorical phenomenon, whereby high vowels devoice phonologically in this morphological environment regardless of the considerations of gestural overlap resulting from fast or slow speech rate, a typological rarity (Gordon, 2000).

Data for this study were collected from one speaker of Lezgi from Northern Azerbaijan. Stems were of the form  $C_1VC_2$  and plural forms  $C_1VC_2-ǂr$ , where  $-ǂr$  is a stress attracting plural suffix that undergoes backness harmony,  $C_1$  is [P], [T], [K], [Q], [s], [ʃ], or [χ], where [P], [T], [K], [Q] stand for any stems beginning with one of three voiceless laryngeal specifications, unaspirated, aspirated or ejective, and V is [i], [u], [y], [e], or [ɑ]. Of the possible 35 consonant-vowel combinations, one combination was not found ([Py]), while 8 other pairs lacked a singular or plural form, leaving a total of 60 words, collected 4 times in a carrier sentence per speed condition (slow, normal, fast) for a total of 720 tokens.

To determine the presence of voiceless vowels, spectral center of gravity (COG) measurements were taken at the period of 80% through the frication of  $C_1$ . In previous studies (C& I, C&B), COG has been shown to be indicative of the identity of following vowels, as movement into the vocalic gesture has begun during the offset of the preceding consonant. Additionally, voicing after the vowel was measured categorically as either voiceless or voiced.

Two linear mixed effects models were constructed to test the vowel devoicing hypothesis, one for fricative-initial and one for stop-initial lexical items. All consonants were found to have a significant effect on COG, while the interaction between consonant and vowel ID was only significant for a subset of pairs. A summary of the coefficients of the fricative model can be found on page two. Importantly however, neither number (singular or plural status) nor the interaction between number and vowel produced any significant difference across COG measurements, which is consistent with the hypothesis that there is no change in vocalic gesture between  $C_1VC_2$  and plural form  $C_1VC_2-ǂr$ .

No changes in voicing were found across speed conditions, indicating that this phenomenon is categorical and non-gradient. This data shows the power of paradigmatic relationships (Steriade, 2000) to prevent the erasure of relevant phonetic information from the singular stem in the plural stem. Additionally, despite the fact that there is no voicing realized during these vocalic gestures, they may contribute nonetheless to the allowance of sonority decreasing clusters. Even without the consideration of voiceless vowels, these patterns are consistent with previous research (Donnelly, 2013) that shows that heteromorphic sequences may be more likely to allow SSP violations. This may not be fully supported in the data, however, as there are some homomorphic lexical items within the language that violate the SSP as well ( $*tʃika > tʃká$ , 'place'). Further research will be required to determine if there are robust statistical differences in the lexicon with respect to these sequences.

## (1) Fricative Consonant Linear Model Coefficients

	Estimate	Std. Error	t-value	Pr(>t)	Sig
(Intercept)	7349.204	45.844	160.310	< 2e-16	***
s	941.091	56.847	16.555	< 2e-16	***
ʃ	-1239.137	72.407	-17.113	< 2e-16	***
a	22.715	84.772	0.268	0.788953	
e	-473.388	84.772	-5.584	6.02e-08	***
i	6.585	88.041	0.075	0.940433	
u	369.600	87.397	4.229	3.28e-05	***
singular	5.213	48.712	0.107	0.914854	
s:a	174.682	108.194	1.615	0.107655	
ʃ:a	-384.056	137.120	-2.801	0.005488	**
s:e	367.727	108.194	3.399	0.000786	***
ʃ:e	189.661	137.120	1.383	0.167827	
s:i	29.596	110.774	0.267	0.789555	
ʃ:i	126.837	166.857	0.760	0.447867	
s:u	11.850	110.263	0.107	0.914502	
ʃ:u	-148.945	143.561	-1.038	0.300487	
a:singular	51.925	86.357	0.601	0.548190	
e:singular	-25.673	86.357	-0.297	0.766486	
i:singular	144.094	111.992	1.287	0.199389	
u:singular	-84.028	86.357	-0.973	0.331462	

## (2) Synchronic Devoicing and Diachronic Deletion

Singular	Plural	Gloss	Historical	Current	Gloss
t'úb	t <sup>h</sup> up'ár	'finger'	*ʃumud	ʃmúd	'some'
k <sup>h</sup> ítʃ	k <sup>h</sup> itʃér	'dog'	*k <sup>h</sup> itab	k <sup>h</sup> táb	'book'
sík'	sik'ér	'fox'	*tʃika	tʃká	'place'
χúk	χuk <sup>w</sup> ár	'stomach'			

**Selected References:** Byrd, Dani. "A phase window framework for articulatory timing." *Phonology* 13.02 (1996): 139-169. Chitoran, Ioana, and Babaliyeva, Ayten. 2007. "An acoustic description of high vowel syncope in Lezgian." *ICPhS* 16: 2153-2156. Chitoran, Ioana, and Khalil Iskarous. 2008. "Acoustic Evidence for High Vowel Devoicing in Lezgi." Davidson, Lisa. 2006. "Schwa Elision in Fast Speech: Segmental Deletion or Gestural Overlap?" *Phonetica* 63: 79-112. Donnelly, Erin. "The sonority hierarchy in Choapan Zapotec." Handout from the International Conference on Mesoamerican Linguistics (2013). Gordon, Matthew. "The phonetics and phonology of non-modal vowels: a cross-linguistic perspective." *Annual Meeting of the Berkeley Linguistics Society*. Vol. 24. No. 1. 2012. Haspelmath, Martin. 1993. *A grammar of Lezgian*. Walter de Gruyter. Selkirk, E.O. "On the major class features and syllable theory." In M. Aronoff, RT Oehrle (Eds.), *Language sound structure*, MIT Press, Cambridge, MA (1984). Steriade, Donca. "Paradigm uniformity and the phonetics-phonology boundary." *Papers in laboratory phonology* 5 (2000): 313-334. Yu, Alan C. L. 2004. *Explaining Final Obstruent Voicing in Lezgian: Phonetics and History*. *Language*, Vol. 80 : 73-97.